





# Key technologies powering the metaverse 赋能元宇宙关键科技

Dr. Christina Yan Zhang 张巘博士 CEO and Founder 总裁兼创始人 The Metaverse Institute 元宇宙研究院 7 July 2023

2nd ITU Forum on "Creating a metaverse for all through international standards" 国际电信联盟第二届"通过国际标准建立一个普惠元宇宙"峰会

2023年7月7日



#### ECONOMIST IMPACT

"The Metaverse has increasingly become a convergence of a whole range of technologies coming together to form the next generation of the internet, which is more interactive, intuitive and immersive."

**Dr. Christina Yan Zhang**Chief executive, **The Metaverse Institute** 

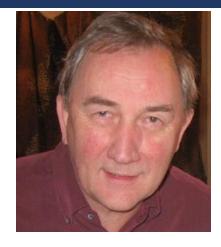


#### **Enterprise Metaverse Summit**

June 28th-29th 2023 | London and virtual

#### My Academic and Professional Work on The Metaverse since 2006











The Use of Second Life as a Tool for **Higher Education Internationalisation** 



The Use of Massively Multiplayer **Online Games to Augment** Early-Stage Design Process in Construction

Christina Yan Zhang

Yan Zhang

the award of Doctor of Philosophy of Loughborough University

A research dissertation submitted in partial fulfilment of the requirements of the award of the degree of Master of Arts Of Loughborough University

September 2007

Supervisor: Prof. Graham Murdock School of Social Sciences

A Doctoral Thesis submitted in partial fulfilment of the requirements for

April 2012 ©Christina Yan Zhang, 2012

#### Prof. Michael Pickering **Emeritus Professor of** Media and Cultural **Analysis**

- The UK's Arts and Humanity Research Council Peer Review College(2002-2012)
- Reviews Editor for the European Journal of Communication
- Editorial board of Memory Studies and the Folk Music Journal
- Founding member of the Communications and Media Studies course

#### Prof. Graham Murdock Professor Emeritus of Culture & Economy

- World renowned founding expert in critical political economy of cultureand communications
- Vice President of the International Association of Media and Communciation Research (IAMCR) (2016-2020)
- Member of the European Science Foundation's Expert Panel of Research Proposal Evaluators
- Founding member of the Communications and Media Studies course

#### **Prof. Peter Golding Emeritus Professor of** Sociology

- World renowned founding expert in critical political economy of culture and communications
- Pro-Vice-Chancellor (Research & Innovation) at Northumbria University (2009-2014)
- Pro-Vice-Chancellor (Research) at Loughborough University (2006-2009)
- Chair of the communications. media and cultural studies sub-panel for 2008, 2014 REF(Research Exercise Framework).
- Chair of the Higher Education **Funding Council for England** Media Studies Advisory Committee

#### Dame Shirley Pearce DBE **Emeritus Professor of Health** Psvchology

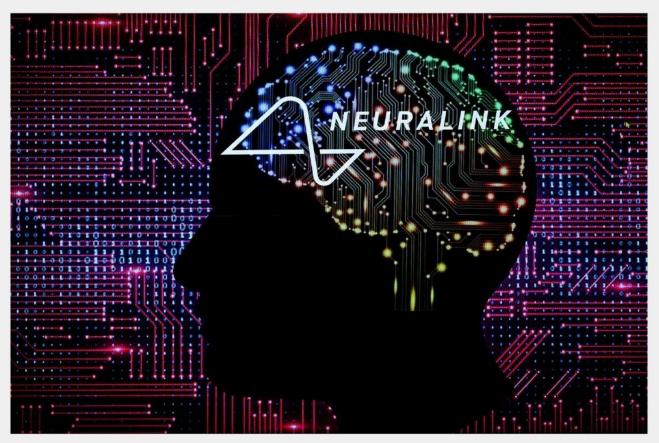
- Vice-Chancellor of Loughborough University 2006-2012
- The inaugural Chair of the College of Policing (the first professional body for policing) 2013-2016
- Chair of Governors of the London School of Economics and Political Science 2016-2020
- Board member at the Higher **Education Funding Council for** England (HEFCE) 2009-2015
- Previous Board member of University of Cambridge, the Healthcare Commission and Health Education England



# **Brain Computer Interface**

#### Brain Computer Implant Being approved for Human Trial-5 June 2023

#### Elon Musk's Neuralink Says It Has Received FDA Approval To Begin Human Trials



#### **BUSINESS**





Neuralink: Elon Musk's brain chip firm wins US approval for human study

3 5 days ago

<



By James FitzGerald

**BBC News** 

Elon Musk's brain-chip firm says it has received approval from the US Food and Drugs Administration (FDA) to conduct its first tests on humans.

The Neuralink implant company wants to help restore vision and mobility to people by linking brains to computers.

#### Synchron- a BCI Startup backed by Bezos and Gates put one BCI in a patient (July 2022) BlackRock Neurotech implants 50 people with brain chips since 2014, including one use BCI to control a robotic arm



#### **Brain implant startup backed by Bezos** and Gates is testing mind-controlled

computing on humans



- Synchron is part of an emerging crop of companies testing technology in the brain-
- . The system is implanted through the blood vessels and allows patients to operate technology using only their minds.
- "It helps them engage in ways that we take for granted," Synchron CEO Tom Oxley



Philip O'Keefe, one of Synchron's patients in the SWITCH clinical trial, using his BC

In a Brooklyn lab stuffed with 3D printers and a makeshift pickleball court, employees at a brain interface startup called Synchron are working on technology designed to transform daily life for people with paralysis.

The Synchron Switch is implanted through the blood vessels to allow people with no or very limited physical mobility to operate technology such as cursors and smart home devices using their mind. So far, the nascent technology has been used on three patients in the U.S. and four in Australia.

"I've seen moments between patient and partner, or patient and spouse, where it's incredibly joyful and empowering to have regained an ability to be a little

Brain-computer startup beats Elon Musk's Neuralink to the punch: NYC patient, 48, with ALS and severe paralysis, has 1.5-inch chip implanted that could allow them to telepathically control digital devices

- · A 48-year-old patient in New York City who is unable to move and speak due to severe paralysis from ALS became the first to receive a permanent brain implant
- The device is part of Synchron's US trial of the brain-computer interface technology, beats Elon Musk's Neuralink to the punch
- 'The first-in-human implant of an endovascular BCI in the U.S. is a major clinical milestone that opens up new possibilities for patients with paralysis'
- The procedure took place July 6 at Mount Sinai West medical center in Manhattan, where a 1.5-inch long implant was put into the patient's brain

By CHRISTOPHER CARBONE FOR DAILYMAIL.COM UPDATED: 18:11, 19 July 2022

Company implants 50 people with brain chips to cure blindness, deafness and depression



**Mad Money** 

JP NEXT | Last Call 07:00 pm ET

The Nokia PS

Tom Wood

A US firm has implanted 50 chips into people's brains, with scientists at the company hopeful that they will one day be able to massively improve the lives of people with paralysis, depression and physical paralysis.

The device is called the NeuroPort Array and it's been made by a company called Blackrock Neurotech. based in Salt Lake City, Utah. The eventual aim of the device is for those implanted with the chip to be able to control robotic arms and electric wheelchairs with their mind, amongst other things.

If this all sounds too futuristic, you're perhaps not too far away from the truth, and it'll probably be a while before they actually get these things outside of the lab.

Nathan Copeland, who was involved in a serious car crash back in 2004, is a pioneer of the technology, having received his implant in 2014.

Technology Review

HUMANS AND TECHNOLOGY

#### Man with brain implant on Musk's Neuralink "I would play video games"

Nathan Copeland, a pioneering research subject, talks about his braincomputer interface and why he's excited for Elon Musk's.

By Antonio Regalado



Portrait of Nathan Copeland, one of the first people to have a brain computer interface, with a robot

· On Musk's plans: "When I heard he was working with a neural interface, I said I would be there in a heartbeat."

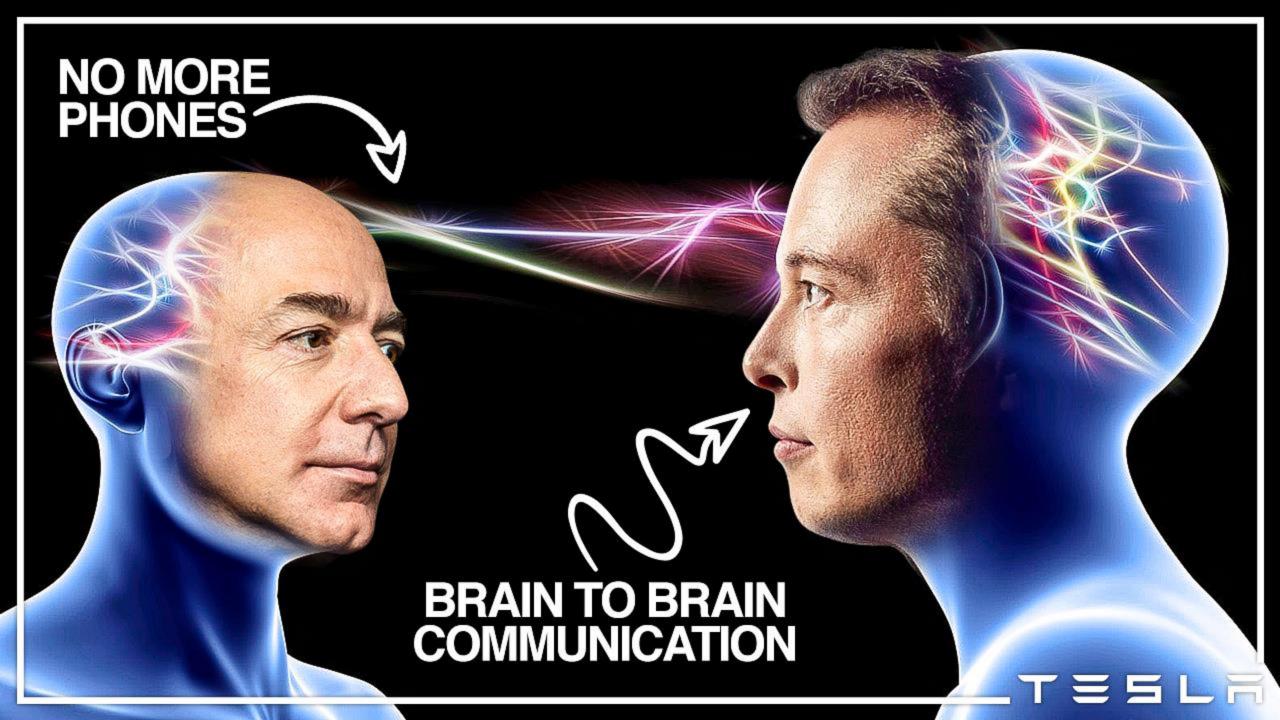
- On the dangers: "If you are comparison shopping for brain implants, I think the Utah array is less risky."
- · On voluntary implants: "Honestly, I would have wanted one before my



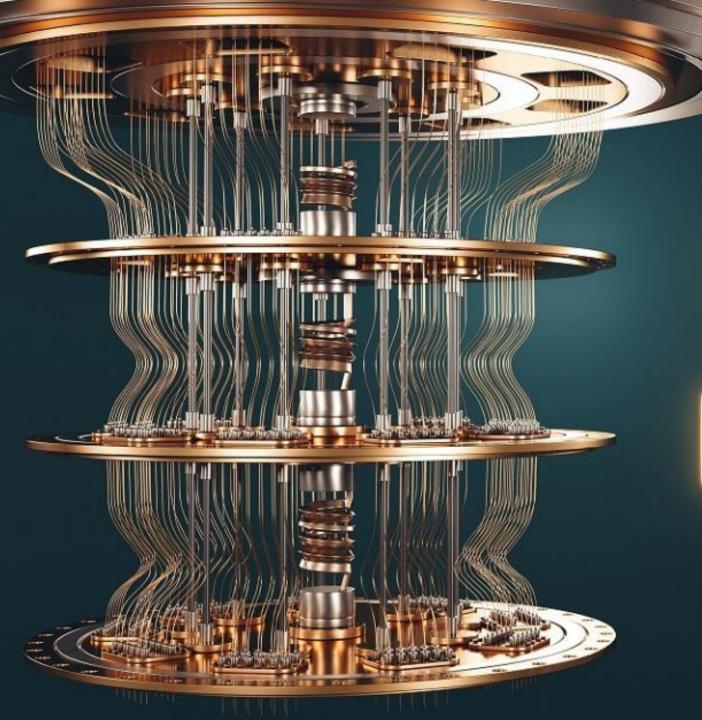
#### Godfather of AI Dr Geoffrey Hinton resigned from Google due to concern on AI ethics

"If you or I learn something and want to transfer that knowledge to someone else, we can't just send them a copy. But I can have 10,000 neural networks, each having their own experiences, and any of them can share what they learn instantly. That's a huge difference. It's as if there were 10,000 of us, and as soon as one person learns something, all of us know it."





# Quantum Technologies



# QUANTUM COMPUTING

#### Quantum Computing will unleash the true potential of the metaverse



#### Quantum Computing Will Be Bigger Than the Discovery of Fire!

Quantum computing is the most underrated, most transformational technological breakthrough since the internet

1d ago · By Luke Lango, InvestorPlace Senior Investment Analyst

- Haim Israel, head of global thematic investing research at Bank of America, believes quantum computing is "a revolution for humanity bigger than fire, bigger than the wheel."
- Scientists at leading tech companies have started to figure out how to harness the power of quantum mechanics to make a new generation of super quantum computers — infinitely faster and more powerful than even today's fastest supercomputers.
- Google has built a quantum computer that's about 158 million times faster than
  the world's fastest supercomputer.
- Quantum computing could allow us to create a million-mile EV rather soon. And through material simulation and battery optimization modeling, it'd also dramatically reduce the costs of EV manufacturing.
- SPECIAL PRESENTATION: The \$5 Stock That Could Make Apple the Next EV Giant





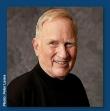








Alain Aspect
Université Paris-Saclay &
École Polytechnique, France



John F. Clauser J.F. Clauser & Assoc., USA



Anton Zeilinger
University of Vienna,
Austria

"för experiment med sammanflätade fotoner som påvisat brott mot Bell-olikheter och banat väg för kvantinformationsvetenskap"

"for experiments with entangled photons, establishing the violation of Bell inequalities and pioneering quantum information science"

#nobelprize





#QuantumComputing #Davos2022

Davos 2022: Quantum Computing is Closer Than You Think.

#### July 2022: Industrial Giant Bosch(€88.2bn annual revenue) champions the world's first Quantum Digital Twin for 240 plants, connecting 120,000 machines, over 250,000 devices-25% productivity increase the year before

newelectronics

02 Aug 2022

#### Multiverse Computing and Bosch unveil quantum **Digital Twin Initiative**

News ( 1 min read

Multiverse Computing, a specialist in quantum computing solutions, has announced that it is working with Bosch on a collaborative research project.



Operating out of the Bosch Automotive Electronics plant in Madrid the collaboration looks to leverage quantum computing in developing a virtual replica or "digital twin" of a factory.

The Multiverse software solution will leverage data to assess the performance of individual equipment as well as broader production processes to enhance quality control and improve overall efficiencies, including energy and waste management.

According to Carlos Conde, Technical Vice President of the Bosch factory in Madrid, "The collaboration with Multiverse is focused on improving the productivity and competitiveness of our factory by researching the use of quantum and quantum-inspired machine learning tools, aligned with our global Smart Factory strategy. We have a great expectation about the results of the algorithms development using our Big Data and about to spread this knowledge within Bosch organisation."

The companies said that they expect to have results of the current phase (development and implementation of customized quantum and quantum-inspired algorithms) in the Madrid facility later this year with a potential integration in a production environment across Bosch manufacturing facilities to follow

"We are excited to team with Bosch to take their connected factory strategy to the quantum level," said Enrique Lizaso Olmos, CEO of Multiverse Computing. "This is one of the first applications of quantum computing with a digital twin. We believe it will provide a whole new level of insight and advantage to Bosch's manufacturing operations."

"This latest Multiverse partnership once again demonstrates the ability for quantum computing to offer real value to companies now, as well as shows the increasing versatility of our solutions." Lizaso said.

To date Industry 4.0 efforts across Bosch's 240 plants have resulted in 120,000 connected machines and more than 250,000 devices. Bosch connected solutions have been able to increase productivity up to 25 percent. In 2021 alone, the company recorded sales of more than 800 million euros with connected solutions for manufacturing and logistics

The Bosch Group is a leading global supplier of technology and services. Its operations are divided into four business sectors. As an IoT provider, Bosch offers innovative solutions for smart homes, Industry 4.0, and connected mobility.



THE BOSCH TEAM WORLDWIDE

88.2

subsidiaries and regional companies

The Bosch Group comprises Robert Bosch GmbH and its 468 subsidiary and regional companies in 60 countries

More than 150 nation alities work at Bosch contributing each day to the success of the

company.



Data Infrastructure >

Security ~

**VentureBeat** 

Automation >

**Enterprise A** 



13 May: 1PM (GMT)

#### **Quantum Computing for Digital Twins**



Every second

smartphone contains

at least one Bosch

sensor.

RESEARCH AND DEVELOPMENT

**85,500** R&D associates at 136 locations worldwide

billion euros expenditure on microelectromechanical research and development

44,000 work at Bosch



Esperanza Cuenca Gómez Head of Strategy & Outreach, **Multiverse Computing** 

Dr. Yong Chen

Professor of Physics and

Astronomy, Purdue University





Michael Grieves

Chief Scientist.

Digital Twin Institute

Dr. Ahmed El Adl **Coined Cognitive Digital** (Twins, Threads & Swarms)



Founder, Quantum Strategy Institut



Dr. Christina Yan Zhang (Chair) CEO, The Metaverse Institute



hashtagweb3.org

# Generative Al



## The Development of Generative Al Application

	PRE-2020	2020	2022	2023?	2025?	2030?
TEXT	Spam detection Translation Basic Q&A	Basic copy writing First drafts	Longer form Second drafts	Vertical fine tuning gets good (scientific papers, etc)	Final drafts better than the human average	Final drafts better than professional writers
CODE	1-line auto-complete	Multi-line generation	Longer form Better accuracy	More languages More verticals	Text to product (draft)	Text to product (final), better than full-time developers
IMAGES			Art Logos Photography	Mock-ups (product design, architecture, etc.)	Final drafts (product design, architecture, etc.)	Final drafts better than professional artists, designers, photographers)
VIDEO / 3D / GAMING			First attempts at 3D/video models	Basic / first draft videos and 3D files	Second drafts	Al Roblox Video games and movies are personalized dreams

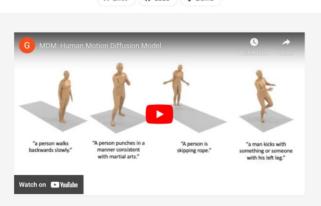
## Generative Al For Metaverse-Text to 3D



Join top executives in San Francisco on July 11-12, to hear how leaders are integrating and optimizing AI investments for success. Learn More

<u>Synthesis AI</u>, a San Francisco-based startup specializing in synthetic data technologies, announced today that it has developed a new way to create realistic 3D digital humans from text prompts.

The company said its new text-to-3D technology, which is showcased in its online platform <u>synthesis labs</u>, uses generative artificial intelligence (AI) and visual effects pipelines to produce high-resolution, cinematic-quality digital humans that can be used for various applications such as gaming, virtual reality, film and simulation.



Guy Tevet, Sigal Raab, Brian Gordon, Yonatan Shafir, Daniel Cohen-Or, Amit H. Bermano Tel Aviv University, Israel

#### Abstract

Natural and expressive human motion generation is the holy grail of computer animation. It is a challenging task, due to the diversity of possible motion, human perceptual sensitivity to it, and the difficulty of accurately describing it. Therefore, current generative solutions are either low-quality or limited in expressiveness. Diffusion models, which have already shown remarkable generative capabilities in other domains, are promising candidates for human motion due to their many-to-many nature, but they tend to be resource hungry and hard to control. In this paper, we introduce Motion Diffusion Model (MDM), a carefully adapted classifier-free diffusion-based generative model for the human motion domain. MDM is transformer-based, combining insights from motion generation literature. A notable design-choice is the prediction of the sample, rather than the noise, in each diffusion step. This facilitates the use of established geometric losses on the location velocities of the motion, such as the foot contact loss. As we demonstrate, MDM is a generic approach, enabling different modes of conditioning, and different generation tasks. We show that our model is trained with lightweight resources and yet achieves state-of-the-art results on leading benchmarks for text-to-proming and artifunct-omotion.



#### World-Class: NVIDIA Research Builds AI Model to Populate Virtual Worlds With 3D Objects, Characters

eptember 23, 2022 by ISHA SALIAN

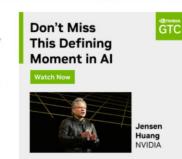




Trained using only 2D images, NVIDIA GET3D generates 3D shapes with high-fidelity textures and complex geometric details. These 3D objects are created in the same format used by popular graphics software applications, allowing users to immediately import their shapes into 3D renderers and game engines for further editing.

The generated objects could be used in 3D representations of buildings, outdoor spaces or entire cities, designed for industries including gaming, robotics, architecture and social media.

GET3D can generate a virtually unlimited number of 3D shapes based on the data it's trained on. Like an artist who turns a lump of clay into a detailed sculpture, the model transforms numbers into complex 3D shapes.



ALL NVIDIA NEWS

The Omniverse Avatar Cloud Engine-"ACE for Games combines the understanding of natural language, text-to-speech conversion, and facial animation, allowing NPCs (None Player Characters) to listen and respond to players in real time.



### 2D Videos into Immersive 3D Environments

#### Digital Renaissance: NVIDIA Neuralangelo Research Reconstructs 3D Scenes

ure 1, 2023 by SRA SALIAN



Reading Time: 3 r

Bay Area campus.







Neuralangelo, a new Al model by NVIDIA Research for 3D reconstruction using neural networks, turns 2D video clips into detailed 3D structures — generating lifelike virtual replicas of buildings, sculptures and other real-world objects.

Like Michelangelo sculpting stunning, life-like visions from blocks of marble, Neuralangelo generates 3D structures with intricate details and textures. Creative professionals can then import these 3D objects into design applications, editing them further for use in art, video game development, robotics and industrial digital twins.

Neuralangelo's ability to translate the textures of complex materials — including roof shingles, panes of glass and smooth marble — from 2D videos to 3D assets significantly surpasses prior methods. The high fidelity makes its 3D reconstructions easier for developers and creative professionals to repidly create usable virtual objects for their projects using footage captured by smarthhones.

"The 3D reconstruction capabilities Neuralangelo offers will be a huge benefit to creators, helping them recreate the real world in the digital world," said Ming-Yu Liu, senior director of research and co-author on the paper. "This tool will eventually enable developers to import detailed objects — whether small statues or massive buildings — into virtual environments for video games or industrial digital twins."

In a demo, NVIDIA researchers showcased how the model could recreate objects as iconic as Michelangelo's David and as commonplace as a flatbed truck. Neuralangelo can also reconstruct building interiors and exteriors — demonstrated with a detailed 3D model of the park at NVIDIA's



#### ALL NVIDIA NEWS



A New Age: 'Age of Empires' Series Joins GeForce NOW, Part of 20 Games Coming in June



NVIDIA and VMware Make Enterprise-Grade XR Streaming Simple

# Meet Neuralangelo: Nvidia's Al Revolutionizing 2D to 3D Video Conversion

By Shobha Kakkar - June 1, 2023



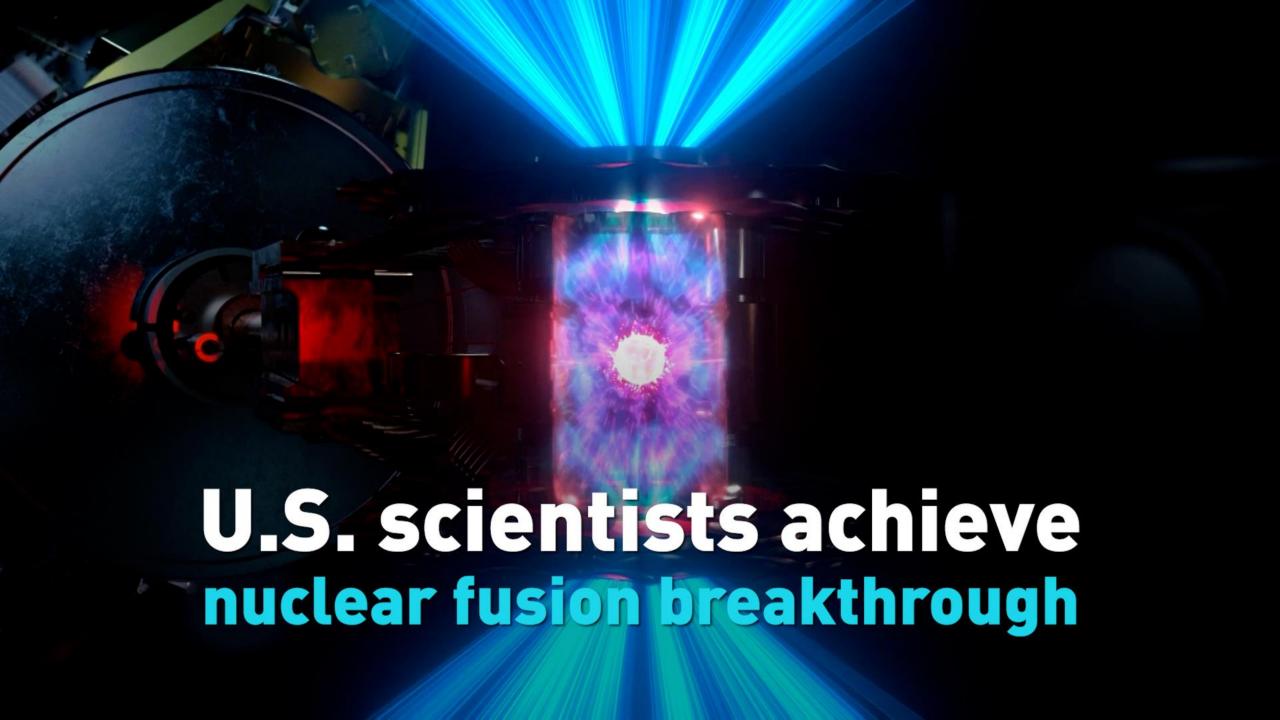
Nvidia, the multinational technology corporation known for its advancements in artificial intelligence (AI), has recently unveiled Neuralangelo, a groundbreaking AI system that can convert 2D video into immersive 3D scenes. This pioneering technology was introduced in an Nvidia blog post dated June 1, 2023.

#### Translating Two Dimensions into Three

Neuralangelo uses a novel AI algorithm to transform traditional 2D videos into immersive, detailed 3D environments. The process involves extrapolating depth and perspective from the spatial and temporal clues embedded in the 2D footage, rendering realistic 3D models from these clues.

## **Sustainability Tech**





#### EU test putting data centre in space to reduce the exponential impact of digital technologies on energy consumption and climate warming VC backed startup Lonestar plans to launch the world's 1st data centre on the moon in 2023



#### **Project description**











#### Data centres... in space

Cameras and sensors from space are keeping close watch of events on the ground and transmitting this data to Earth. But sending data to the ground takes time. One solution is to launch data centres into orbit. This would reduce the exponential impact of digital technology on energy consumption and climate warming. The installation of large modular space infrastructures with robotic assembly, megawatt level space-based solar power, high throughput optical communications, low cost and reusable launchers is within reach. The EU-funded ASCEND project will introduce a pioneering new on orbit services system concept. This would make Europe a world leader in robotised and sustainable modular infrastructures as well as reusable launchers.

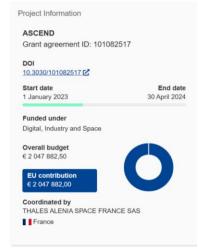
Hide the project objective

#### Objective

This proposal introduces a pioneering new on-orbit services system concept which would rapidly industrialize the European space ecosystem, making Europe a world leader in robotized and sustainable modular infrastructures as well as reusable launchers, with additional competitive benefits for a sustainable European digital industry and sovereign cloud autonomy

European space technology has now reached a level of maturity that makes possible a revolutionary - yet feasible endeavour; the installation of internet data centres in orbit, in order to reduce the exponential impact of digital technology on energy consumption and on climate warming. The installation of large modular space infrastructures with robotic assembly, megawatt level space-based solar power, high throughput optical communications, low cost and reusable launchers, is now within the European space industry's capability.

The goal of the proposed study is to demonstrate that placing future data centre capacity in orbit, using solar energy outside the earth's atmosphere, will substantially lower the carbon footprint of digitalization. Space data centres could therefore become an active contributor to the EC Green Deal objective of carbon neutrality by 2050, which would justify the investment required to develop and install such a large space infrastructure system. It would also strengthen Europe's digital sovereignty and autonomy, for a sustainable and prosperous digital future. Given the ambition and huge potential impact of this project, which would become a major European flagship program, a broad system-level feasibility and business study is necessary. For that purpose, the ASCEND consortium has brought together major players in the fields of environment analysis (Carbone 4, Vito), data centres architecture, hardware and software (Orange, CloudFerro, HPE), space systems development (Thales Alenia Space, Airbus, DLR), and access to space (ArianeGroup).



#### Lonestar Data Holdings Inc. Successfully Completes \$5m In Oversubscribed Seed Financing

NEWS PROVIDED BY Lonestar Data Holdings Inc. → 06 Mar, 2023, 06:00 ET











Groundbreaking start-up working to create a new data center industry from the Moon clears key financing milestones

ST. PETERSBURG, Fla., March 6, 2023 /PRNewswire/ -- Lonestar Data Holdings Inc. announced today that it has successfully closed its \$5m Seed with this financing round being oversubscribed

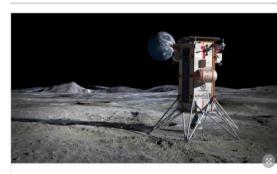
The round has been led by Scout Ventures and joined by Seldor Capital, 2 Future Holding, The Veteran Fund, Irongate Capital, Atypical Ventures, and KittyHawk Ventures. Lonestar is scheduled to launch a series of data centers to the lunar surface in 2023.

"We are thrilled to have completed this successful seed round and are sincerely grateful for the support and vision of our investors," said Chris Stott, CEO of Lonestar.

"We believe that expanding the world's economy to encompass the Moon, which happens to be the Earth's most stable satellite, is the next whitespace in the New Space Economy," says Scout Ventures' Founder and Managing Partner, Brad Harrison. "Data security and storage will be a necessary part of leading the new generation of lunar exploration."

The VC funded startup is working to revolutionize premium mission critical data services and communications from Earth's largest satellite, the Funding oversubscribed for US Start-Up, Lonestar, launching first data centers to the Moon in 2023.





Funding oversubscribed for Lonestar, US Start-Up putting the first data centers on the Moon in 2023.

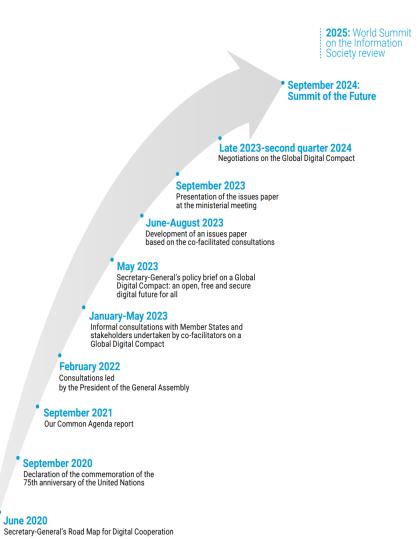
The successful closing of the company's Seed funding round is a major milestone for Lonestar and will help the team to accelerate its growth and expand its offerings to meet the needs of its clients around the world.

About Lonestar - Saving Earth's Data One Byte at a Time

Lonestar Data Holdings Inc. (Lonestar®), headquartered in St Petersburg's Maritime and Defense Technology Hub, has been founded by a proven team of experts from the Cloud and Space verticals to pioneer a future for data at the edge for all of us. www.lonestarlunar.com

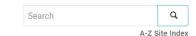
#### May 2023: UN Secretary General: Establish a Global Digital Compact for an Open, Free, Secure Digital Future for all

TIMELINE OF THE GLOBAL DIGITAL COMPACT





#### Office of the Secretary-General's Envoy on Technology

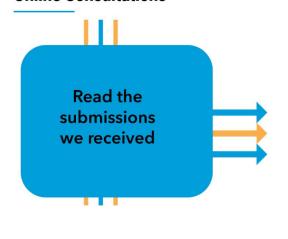




#### **UN Secretary-General's Policy** Brief



#### **Online Consultations**



#### **Background**

Following the political declaration adopted at the occasion of the United Nations' 75th anniversary in September 2020, the Secretary-General in September 2021 released his report Our Common Agenda A. The Common Agenda proposes a Global Digital Compact to be agreed at the Summit of the Future in September 2024 through a technology track involving all stakeholders: governments, the United Nations system, the private sector (including tech companies), civil society, grassroots organizations, academia, and individuals, including youth.

The Global Digital Compact is expected to "outline shared principles for an open, free and secure digital future for all". The Common Agenda report suggests issues that it might cover, including digital connectivity, avoiding Internet fragmentation, providing people with options as to how their data is used, application of human rights online, and promoting a trustworthy Internet by introducing accountability criteria for discrimination and misleading content. Find out more here.

June 2020

Recommendations of the Secretary-General's High-Level Panel on Digital Cooperation

September 2020

February 2022

Consultations led

Our Common Agenda report

September 2021

Online Consultations run June 2022 through April 2023

# Tampere Metaverse Vision 2040

The World's First People Centred Metaverse Strategy





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# Christina Yan Zhang



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